Extraction of Obstructed Objects from Noisy Images Using Fast Fourier Transforms

Terry Mizell, Ph.D.   Bill Clemons, MS.   Paul Lockhart

Alabama Agricultural and Mechanical University   P.O. Box 968
Normal, Alabama 35762-0968   (256) 851-5657

Abstract

The intent of the research project described by this paper was to explore a number of approaches for target extraction from a 'noisy' background. This has relevance for target identification, mission planning, drug interdiction, and other challenges of a general intelligence nature. Several approaches were included in the fundamental research, but only Fast Fourier Transform methodology will be discussed in this presentation. Fast Fouriers are frequently employed in this type of problem, but it was part of the intent to determine the limits of this methodology vis a vis other, newer approaches, such as wavelets. The platform for the analysis, code generation, and comparison study was a Pentium II, 500 MHz, with an Elsa "Gloria" graphics card.

In order to facilitate the extraction of targets from obscured, noisy images, a computerized tool was built, consisting of 1,200 lines of well-commented Visual BASIC code, (not including the 'wizards') which employed the FFT algorithms to read the clean bitmaps and the noisy bitmaps. The model employing the FFTs is capable of detecting the 'edges' of the target, and some of the salient features. (The code is included as part of the body of this paper.) The tool will be of some value to the sponsor, in that it will allow the user to enter any bitmapped image into the analysis. The images extracted were reasonably small (4" x 6") and as such the bit mapped matrices are small. The images consisted of a number of military vehicles, tanks, and warships, each of which were obscured by camouflage or "noise," resembling fog.

Basically, the system was fairly efficient in backing out the images from the clutter, but it had some constraints. One of our more significant findings was the FFT algorithms begin to lose effectiveness with more than 60% random noise added, or when more than 70% of the body of the target was obscured by foliage or camouflage. Within the constraints of our approach, they simply did not have the computational 'clout' to back the features out from the clutter. This is felt to be a significant shortfall, given the constraints of the hardware and software. But, as the reader can surmise, 60% distortion is a fairly significant amount. We feel that with some further analysis and refinement of these algorithms, a useful image can be recovered from a higher noise factor.